Introduction to basic probabilistic concepts and methods used in computer science. Develops an understanding of the crucial role played by randomness in computing, both as a powerful tool and as a challenge to confront and analyze. Emphasis on rigorous reasoning, analysis, and algorithmic thinking.

Credits: 4. Counts as a CS Background course for the concentration.

Undergraduate Prerequisites: MA123 (or equivalent); CS131; CS132 (or CS235, or MA294). We assume good working knowledge of elementary set theory and counting, and elementary calculus (i.e., integration and differentiation). These topics will be very quickly reviewed in the first weeks of the course, and are also covered in Chapters 1-2 of the Schaum’s Outline text, which you can read on your own, in case you need a refresher.

Instructor: Doctor Esther Galbrun, galbrun@cs.bu.edu, MCS 207, 111 Cummington Mall.
Teaching Fellow: Sanaz Bahargam, bahargam@bu.edu, MCS 217, 111 Cummington Mall.

Course Schedule

Lectures: Mon, Wed, Fri 10:00am – 11:00am. Bld. EPC Room 209.

Discussion Hours: Mon 1:00pm – 2:00pm. Bld. MCS Room B21.  Mon 2:00pm – 3:00pm. Bld. MCS Room B19.

Instructor’s Office Hours: Wed 1:00pm – 4:00pm. Bld. MCS Room B29.
TF’s Office Hours: Thu 9:00am – 12:00 noon. Bld. MCS Room B29.

Textbooks


The lectures will mostly follow selected chapters of the lecture notes from *Mathematics for Computer Science* by Meyer. The full lecture notes are available for download: http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2010/readings/MIT6_042JS10_notes.pdf

*Schaum’s Outlines, Probability* contains complementary explanations and exercises, some of which will be used as practise problems and discussed during classes.

Additional material can be found in *Probability and Computing,* especially on the more advanced topics. The latter two textbooks are available for purchase in the campus bookstore.
Course organisation

The course consists of in-class lectures, practice problems, labs and tests.

Attendance and active participation in the lectures is strongly encouraged. You are responsible for all material covered in lectures. Some lecture material may not appear in the textbooks.

Practice problems will be discussed with the TF during the discussion hours. The problem questions will be available a few days ahead of time and you are responsible for solving them before coming to the discussion hour. This will help you prepare for the tests. The practice problems will not be graded.

There are two discussion sections. If for some reason you cannot attend the section you have signed up for, arrange with the TF to attend the other one. If you have a permanent scheduling conflict, please discuss this with the TF.

Labs will involve significant analytic (math) and programming (in python) work on an application of probability in computer science. Material for the lab, including a review/introduction to the python programming language, will be covered in the discussion sessions, but the labs themselves should be completed on the student’s own time. The TF will hold some of his office hours at the undergraduate computer lab; students are encouraged to attend these office hours to get help with the labs.

Labs will be graded. There will be four to five lab assignments, worth a total of 30% of your final grade.

Communication

Blackboard: This course website is up on Blackboard: [http://learn.bu.edu/](http://learn.bu.edu/).

The updated course calendar, material references, problems and labs questions, etc. will be made available through the Blackboard course website.

The Blackboard course website will also be used to submit the lab assignments.

Piazza: We will also use Piazza to communicate during the course: [piazza.com/bu/spring2015/cascs237](piazza.com/bu/spring2015/cascs237)

Please make sure you are aware of announcements on Piazza!

You are encouraged to post any general course- or homework-related question to Piazza and discuss among yourselves on that platform. The discussion on Piazza will be monitored by the TF and Instructor and open questions will be answered regularly.

Email: Please only email the TF or Instructor directly if you have a personal issue that cannot be posted on Piazza and make sure that all course-related email has “CS237” in the subject line.

Technical questions, e.g. about course material and problems, should be posted through Piazza since their discussion will benefit everybody else in the class, such questions will not be answered privately via email.

Office Hours:

The TF and Instructor hold separate office hours, to which you are encouraged to come. If you need to talk to us in person but absolutely can’t make the office hours, please send us an email with at least three options for when you are available.

Getting help

If you have questions about the practice problems, the labs, or any of the course material, there are a number of resources available to you.

You should not:

- Keep quiet, as you might get off-tracks quickly.
- Copy solutions to problems and labs. Such behavior is forbidden and will not help you learn and understand.
- Send personal emails to the Instructor or TF regarding the course material. These emails will not be answered.
You should:

1. Talk to your classmates about the problems (but, see the class collaboration policy below).
2. Post a question to the Piazza board. If you are stuck on something, it’s very likely that some fraction of the class is also stuck and you are helping everyone by raising the issue.
3. Attend a discussion section and participate in discussing the issue there.
4. Come to the TF or the Instructor’s office hours.

Collaboration Policy

Learning probability takes practice. The purpose of the labs and practice problems is to help you learn. The purpose of the tests is to evaluate this knowledge. For this reason, you are encouraged to collaborate with one another in studying the course notes, textbooks, and lecture material.

Collaboration on the assignments is permitted and will not reduce your grade, under the following conditions:

- You must write up your solutions completely on your own, without looking at other people’s write-ups.
- In your solution to each lab, you must write the names of those with whom you discussed it, and all the references (textbooks, wikipedia, etc.) you used to solve the problem. If you did not use any online sources or textbooks or discuss the problem with any of your classmates, please explicitly indicate that on your submitted lab.
- You may not work with people outside this class (but come and talk to us if you have a tutor) or get someone else to do it for you. You may not use solutions you obtained from a classmate who has taken this course in previous years.

Deviations from this policy will be taken very seriously.

Note that you will not be permitted to collaborate on the tests. If you don’t make an honest effort but always get ideas from others, your exam score will reflect it. It is your responsibility to know and understand the provisions of the CAS Academic Conduct Code.

Submitting assignments

Unless otherwise mentioned, labs are due at 12:00 noon on their assigned dates. Lab assignments will be submitted electronically through the Blackboard course website.

Format: Assignments must be submitted as a PDF.

You may choose to hand-write your assignment and then scan it in before submitting, or you may choose to type up the assignment and then convert it to a PDF.

The preferred option is to use LaTeX to prepare your assignment. A LaTeX source of the homework will be made available for students who would like to format their work as LaTeX and you are encouraged to use it.

Whatever format you choose to use, it is crucial that the electronic version of your assignment is legible. Illegible assignments will not be graded kindly.

You might be asked to provide an archive with additional material such as source code, etc.

Every submitted assignment MUST contain the following:

- your name,
- the name of any classmates you discussed the assignment with, or the words “no collaborators”,
- a list of sources you used (textbooks, wikipedia, research papers, etc.) to solve the lab, or the words “no sources”, and
- number of late days used for the current assignment, and total number of late days used up thus far in the semester (include on the current assignment).
We will deduct at least 20% of the points from submitted assignments that fail to include the four items above.

**Late submission policy:** Labs must be submitted on time. Students will be given a total of 3 “penalty-free” late days to use on any submitted lab at any point during the semester; once these late days have been used up, all late assignments will be given a grade of 0. All submitted labs should include a running count of the number of late days used up on that specific lab, as well as during the whole semester (see above).

To understand how we count days, we’ll use an example. *Suppose that a lab is due 12:00 noon on April 1st. If a student submits that lab at 11:32pm on April 1st, that student has used up one “full” late day. There are no fractional late days.*

Please only email the Instructor to ask for modifications to this policy if you are in truly extraordinary circumstances.

**Tests and Grading**

There will be a quiz, a midterm, and an exam. This course is cumulative; thus each test will cover all the material covered in the course, from the first day of the semester until the date of the test.

The quiz will be in class, on Wednesday, March 4, 10:00am – 11:00am (tentative), and the midterm will be in class, on Monday, March 30, 10:00am – 11:00am (tentative).

All tests are closed book, but you may bring your own hand-written double-sided “cheat sheet” and old-fashioned calculator (not a phone, or device that can connect to the Internet) with you to each test.

The grading formula is as follows (we reserve the right to deviate from this formula).

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<thead>
<tr>
<th>Activity</th>
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<tbody>
<tr>
<td>Labs</td>
<td>30</td>
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<td>Quiz</td>
<td>10</td>
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<tr>
<td>Midterm</td>
<td>20</td>
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<tr>
<td>Exam</td>
<td>35</td>
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To encourage active participation in class during lectures and discussion hours as well as outside the class, for instance by raising or answering questions on *Piazza*, such positive activities will be taken into account when deciding the final grade.

**Regrading:** Grading will be managed by the TF. If you would like to request a re-grade of an exam question or an assignment, be aware that question or assignment will be completely re-graded (and potentially result in a lower grade). The Instructor will address re-grading issues only after they have been seen by the TF.

**Topics**

The following is a tentative list of topics, which might be subject to change. The relevant textbook references will be provided at the beginning of each lecture.

- Set theory, counting, calculus review.
- Basic probability, events, random variables.
- Conditional probability
- Independence, universal hashing.
- Distributions (Binomial, bernoulli, geometric, gaussian), expected value.
- Variance, sampling, confidence.
- Inequalities (Markov, Chernoff, Chebyshev), other topics.